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RADIUM

EDITED BY
CHARLES H. VIOL, Ph. D.
AND
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VOL. IX SEPTEMBER, 1917 No. 6

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A MONTHLY JOURNAL DEVOTED TO THE CHEMISTRY PHYSICS AND THERAPEUTICS OF RADIUM AND RADIO-ACTIVE SUBSTANCES

RADIUM

A MONTHLY JOURNAL DEVOTED TO THE CHEMISTRY, PHYSICS AND THERAPEUTICS OF RADIUM AND RADIO-ACTIVE SUBSTANCES.

Edited and Published by Charles H. Viol, Ph. D., and William H. Cameron, M. D with the assistance of collaborators working in the fields of Radiochemistry, Radioactivity and Radiumtherapy.

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VOL. IX SEPTEMBER, 1917 No. 6

THE MEDICOLEGAL ASPECTS OF RADIUM-THERAPY*

By Joseph B. Bissell, M. D.
New York

Visiting Surgeon, St. Vincents Hospital; Surgical Director, Radium Sanatorium of New York; Consulting Surgeon, Hospital for Deformities and Joint Diseases; Director and Visiting Surgeon, Bellevue Hospital.

All remedial agents used in the art of healing are subject to various forms of application which may result through proper use in a relief of the condition treated or by improper application may bring about disastrous results to the patient and to the practitioner alike. Damages accruing from faulty instructions of a mechanical engineer may quickly cause a financial loss enormous in proportions. It is rare that we find mistakes evidenced in the chemical formulas evolved by the operators laying out work in our great commercial organizations. In that branch of science which has for its purpose the study and treatment of the human body we unfortunately find all too frequent evidence to show that mistakes, errors in judgment, and lack of technical knowledge play sad havoc in their result. It is therefore most fitting that we bring to your attention the true status of affairs that may relate to the application of radium in medicine and surgery.

The Local or External Application of Radium—Possibly, no subject in medicine or surgery has so widely interested the lay public as has radium. This interest is stimulated by belief that there may lie in this substance that which will ultimately bring us a cure to the most horrible of all diseases, cancer. That we can reasonably look forward with an ever-increasing degree of hope in this agent is made clear by the remarkable success that is being attained in the treatment of malig-

*Medical Record, pp. 102-104, July 21, 1917.

nant conditions purely superficial in type. The clinical improvements and apparent cures in those cancerous masses to which radium can be directly applied run well over 80 per cent. and are increasing in proportion with our knowledge of better technique and an understanding of accurate dosage. It will further interest you to know that those deep-seated growths located in the interior of the body, in its cavities, etc., held as incurable, are giving increasing promise as we find means of applying this active element directly to the mass. It would not be proper in making such statements as this to lay the entire claim for this beneficent influence on radium alone. We must clearly understand that radium is but one of the means at the command of the surgeon and we must rely upon his ability to know when to discontinue his work with the knife and take up another instrument whose application is far more humane and yet deeper and more effective in its power. The space allotted to me will not permit me to go into the various forms of technique used in the treatment of the types of cancer that come to the surgeon for remedy.

Internal Use of Radium—More than ten years of clinical achievement at the great hospital centers of Europe where radium has been used internally give us certain definite knowledge as to its value for the treatment of many diseases dependent on early degeneration of the kidneys, heart, and blood-vessels associated with imperfect elimination of the body's waste products, causing self-poisoning of the patient. Such diseases as nephritis, arteriosclerosis, and various forms of arthritis or rheumatism, so called, which we commonly know to incapacitate so many men in early years are now held as curable or controllable to a large degree by radium-therapy, properly administered. Innumerable are the channels of hopeful therapy that follow the administration of the emanation of radium in cases evidencing faulty cell activity and circulatory changes.

Let this suffice as a general classification for the more common indications for the use of radium in its various forms and from such a theme, let us make our deductions as to the medicolegal aspects resultant from the use of radium. When radium is applied locally we look forward to certain anatomical and physical changes. If the type of the mass and the character of its cell structure are thoroughly understood we will hope to see its activity of growth checked, the tumor being decreased in size, either without any apparent breaking down of its structure or by degeneration of the mass and a general sloughing off of its substance. Under successful treatments the classic result shows a disappearance of the growth entirely. Where such results are not to be obtained due to the uncontrollable activity of the cancer cell we may be justified in answering that as yet there is little to hope for in the way of promised cure, but we may apply radium in such a case, because of our definite knowledge that radium will largely control the hemorrhage, reduce the odor, hold in check the symptoms of pain, modify to a large extent the active congestion present, and restore to the patient hope. These briefly are the possibilities for local application.

The medicolegal aspects of such treatment will depend on two general classifications, the ability of the surgeon in diagnosis and statements relating thereto and the quality and quantity of the radium element at his command and his ability to estimate proper dosage. It is

most natural to assume that the practitioner would hesitate to specialize in the treatment of malignant diseases either with the knife, caustic pastes, or radium unless he had derived extensive knowledge as a clinician and was backed up with suitable laboratory facilities to insure correct diagnosis. It is the duty of the operator for his own protection and for the benefit of the patient to know as far as possible the exact type of the growth to be attacked. Certain types of cancer present tremendous activity in growth and require a large amount of radium coupled with long periods of application. Other structures exhibiting cell growth of lower vitality can easily be treated with smaller dosage. Then again there are certain locations in the human body, such as in the region of the mouth and throat, wherein we are possibly not justified in making any operative procedures even for microscopic examination. In this region active growth most grave in its type frequently follows surgical interference.

So far as radium itself is concerned there are four possible channels of danger from its applications; namely, from a dosage applied in the regions like the bladder, stomach and esophagus resulting in a burn following which might come penetration, infection and death; secondly, from the possibility of activating the growth of cancer cells by an insufficient dosage; thirdly, the possibility of danger from the action of radium directly on the walls of large blood-vessels lying in the immediate vicinity of the mass treated, causing a rupture of the blood-vessel and fatal hemorrhage following the effects of a burn: fourthly, the possibility affecting the ovary when radium is applied in regions in close proximity to it. Radium burns in general have no terrors. A troublesome burn at times will occur where an extremely large dose of radium has been given and screened with most careful technique. There are certain cases, such as those of extreme malignant type met in the throat, that we treat with the heaviest dosage possible with the full expectation that we will get a deep severe burn. We would not be giving sufficient dosage did we not get such a manifestation. The one hope in a desperate case of cancer of the tongue is to give the man the heaviest dose of radium possible and screen it in such a manner as to permit him to secure practically all the available energy of the radium. He is therefore told that a burn will probably develop and every such radium patient should be similarly warned. There is absolutely no danger in a radium burn other than penetration. The surface heals slowly, sometimes taking weeks and months to recover. At times following heavy ray treatment we find a resultant heavy layer of fibrous tissue which may remain permanently.

Undoubtedly, insufficient dosage of radium at times tends to increase the growth and activity of cancer structures. This cannot be held, however, in condemnation of radium because in all probability at the stage reached any interference, whether it be a knife, caustics, or radium, would possibly exert the same influence. However, it is extremely important that a proper dosage be administered. The serious consequences coming from the application of radium without every precaution in the neighborhood of large blood-vessels would undoubtedly be a reasonable subject for medicolegal consideration. Properly administered, radium has been used in this country in local application with

doses varying from two milligrams to one thousand milligrams without effecting burns which would have any medicolegal aspects. Of course, such treatments were carried on with perfect technique. In working in the vicinity of such organs as the eye, one must naturally protect, by sufficient screenage, that portion not affected by the cancer. Nature has considerately protected the radium worker by giving resistance to normal tissue of many times that of the cancerous structure and therefore it is possible for us to apply very large dosage, destructive in type, to the cancer mass and not do serious damage to adjoining tissue. Radium should in no wise be considered a caustic or tissue-destroying agent. Its destructive properties come from the action of radium directly on the blood-vessels of the structure. There may possibly be a further action on the intercellular substances; the nutrition being cut off from the mass causes its death and degeneration. There are but few opportunities for a scientific worker with radium to make mistakes and we trust that so powerful and energetic an agent as radium will not be placed in hands improperly schooled. The dangers of the gamma ray from *x*-ray treatment are of common knowledge to everyone, and we find some people confuse the gamma ray of that apparatus with radium. They are analogous but not at all similar, and where the *x*-ray burn at times develops into cancer the radium burn is inert and is itself used to cure the *x*-ray malignancy.

With, then, practically nothing to fear from the proper use of radium and but few opportunities for mistakes, the medicolegal aspects rapidly dwindle to practically nothing. The sins of radium are more of omission than of commission.

Just a word relating to the internal administration of radium. This branch of radium therapy is of equal importance with the local application and its responsibilities are often greater. With radium it is possible at times to restore to usefulness the man who in the prime of life is crippled to invalidism by a rheumatic affection.

Radium may serve to control certain of the dangers of high blood pressure commonly met in the arteriosclerosis case or markedly influence the metabolism and elimination in cardiac and nephritic patients. If such results are forthcoming from the use of radium emanation then it is truly a most important remedy. With this in view, let us ask ourselves the question, What is the danger or medicolegal aspect as relates to the internal administration of radium? In answer to this I would say that experience has shown that radium is accepted as harmoniously in the body as is sunlight by the withering plant. Doses have been administered to use a common unit of from 500 M. U. to 27,000,000 M. U. of emanation without danger or harmful influence. Radium injected into the blood can easily be traced in its elimination, and while it is active for many weeks, its complete disappearance from the body is assured. Definite measurements governing elimination are at hand. There seems to be no evidence that would point to any danger from radium when used internally. One point of warning, however, must be offered. Unqualified practitioners, poor diagnosticians, and men lacking clinical experience could, of course, make mistakes and cause damage even with radium. It is to be regretted that there are still men in the practice of medicine who are not qualified by an experience or ability to be treating human kind. If we have an ex-

tremely high blood pressure of the compensating type, such pressure possibly should not be reduced. It is accomplishing its purpose. The only reduction that should be attempted in such a case would be that secured by a combined treatment of both cause and effect. That radium does exert a remarkable influence in the treatment of arthritis, gout, and diseases of faulty elimination in general must be acknowledged, and the time will soon be at hand when the practitioner who does not use all methods of treatment at hand before failing in his arteriosclerosis cases, in administering aid to his desperate rheumatic patients, and who does not relieve those diseases of the heart and kidneys by advanced measures of therapy when indicated, will be guilty of malpractice, and so charged.

46 WEST FIFTY-FIFTH STREET.

REVIEWS AND ABSTRACTS

Symposium on Radium Therapy. American Gynecological Society. Forty-second Annual Meeting, held at Pittsburgh, May 31 and June 1, 1917. Jour. A. M. A. LXIX, No. 2, July 14, 1917, pp. 144-5. *Methods and Results of Radium Treatment of Uterine Hemorrhage Due to Other Causes than Malignancy*—DR. HOWARD A. KELLY, Baltimore: Radium therapy here is as simple and as safe as a dilation of the cervix, and consists in nothing more than introducing a uterine sound with a hollow tip containing 500 millicuries of emanation and applying it successively to eight different points in the uterus, fifteen minutes at each point. This practically always cuts short the menstrual function, and so simply obviates the need for a hysterectomy. In young women, menstruation can sometimes be modified without even suspending it. In one case pregnancy and delivery of a healthful child followed the treatment. Seven of 100 patients had heart disease, two epilepsy, two insanity, and others Bright's disease and tuberculosis, manifestly bad risks for hysterectomy. No serious sequelae follow the radium treatment. Practically in all cases of fibroid tumors, radium has checked the monthly flow completely when desired. In young women it has been possible in some instances to cause the tumor to disappear without stopping menstruation permanently."

"Radium in the Treatment of Uterine Hemorrhage and Fibroid Tumors—DR. C. JEFF MILLER, New Orleans: In the treatment of uterine bleeding from various causes, radium is almost a specific. Its most striking effect is its certain control of uterine bleeding due to the metropathies, or aberrant ovarian function. Aggravated cases of the menopause, usually relieved by hysterectomy, can be controlled by a single application of radium. Similar results are obtained in bleeding complicating fibroids of the uterus, and certain types of fibroids may disappear or markedly shrink. Radium will not supersede surgery in the treatment of fibroids. Large growths giving rise to pressure symp-

toms, or presenting evidences of degeneration, as well as submucous tumors, should be treated surgically, if operation is not contraindicated. When desirable to preserve the function of the generative organs in young women, surgery should be considered the more conservative procedure, since it permits myomectomy. Its effect in controlling bleeding associated with chronic metritis and polypoid endometris is equally satisfactory, and when the dosage and screening are carefully measured, it may be used as a last resort in excessive bleeding in young girls, without causing cessation of the menses. Itching associated with kraurosis of the vulva, as well as pruritus, can often be allayed by radium."

"Radium Therapy in Uterine Hemorrhage of Benign Origin—Dr. John G. Clark, Philadelphia: In cases of hemorrhage of the uterus of benign origin, such as that from small myomas or myopathic change, particularly in women over 38 years of age, radium in small doses is one of the most effective remedies, relieving practically all of the patients from even the slight hazard of a major surgical operation. The hemorrhages in such cases stop promptly and with rare exceptions permanently, without untoward effects incident to the use of radium. Those near the menopause respond best. Cases in former years, in which even repeated curettages failed to alleviate the hemorrhage, are promptly terminated after the application of 50 mg. of radium for twenty-four hours. In over 100 cases there has been but one failure to relieve the hemorrhagic symptoms."

"Radium in Uterine Cancer—Dr. Harold C. Bailey, New York: The platinum applicators holding large amounts of radium emanation are placed in an iron capsule containing mercury. This mercury "bomb" offers efficient protection to the normal tissues and permits of the entire lower part of the pelvis being swept with a sufficient dose in a period of usually not more than four or five hours. In addition, heavy applications are made over the lower part of the abdomen in three areas and directed toward the upper part of the pelvis. In this manner, from the standpoint of the amount of radiation, three or four times the dose possible with the ordinary technic can be directed into the pelvis without subsequent irritation."

Discussion—Dr. Francis Carter Wood, New York: I have had little personal experience with the use of radium in the treatment of uterine hemorrhage. Those cases I have seen have suggested the necessity of an accurate preliminary diagnosis of the condition of the endometrium by the thorough microscopic study of curettings removed with care so as to obtain as large fragments as possible and promptly preserved. Without such precautions in obtaining the material, a satisfactory study is often impossible. I have seen a few cases treated in which the radium did not cause a cessation of the hemorrhage until such doses had been administered as to cause atrophy of the ovaries. As to the treatment of fibroids, I feel from my pathologic experience that only a moderate percentage can be properly handled by radiation. It must be remembered that after extensive radiation, hysterectomy, should it prove necessary, may be very difficult, owing to the cartilaginous fibrosis of the parametrium.

Dr. Herman J. Boldt, New York: While radium has certain advantages in the treatment of hemorrhages from benign causes, I have

failed to hear the final results from its use. Similar results may be obtained from the proper intra-uterine application of zinc chlorid. The advantage of radium is that fewer applications may be necessary. One may obtain a result after one or two treatments which may require a dozen treatments by zinc chlorid. Radium may cause less pain than zinc chlorid, but the proper application of a 50 per cent. solution of zinc chlorid in the form of an intra-uterine tamponade will bring about a result equally as good as that by radium so far as the cessation of hemorrhage is concerned.

DR. ERNEST C. SAMUEL, New Orleans: When the hemoglobin is low, I have found that a smaller dosage of radium spread over a longer period of time produces less toxic symptoms than a large dose given for a shorter length of time. Almost 90 per cent. of patients for whom I make intra-uterine applications or applications around the cervix develop a distressing nausea and vomiting and some elevation of temperature.

DR. HENRY SCHMITZ, Chicago: I believe the radiotherapist who uses small amounts of radium obtains as good results as the man who uses larger amounts. In benign conditions we use fewer milligrams of radium, and the physical condition of the patients is much better than in malignant conditions. The malignant cases frequently show advanced cachexia and anemia. The resistance of these patients is materially lowered, and in such cases it is necessary to use larger amounts of radium rays than in nonmalignant conditions."

DR. WILLIAM P. GRAVES, Boston: One thing I have noted which has not been mentioned, that the successful reaction of the cancer cells to radium depends considerably on the histologic structure of the cancer. Cancers that are purely squamous in type, starting from the portio vaginalis, are much more favorable to treatment. Those are the cases in which I find the disease disappears like magic. But those cancers which originate in the endocervix, that is, adenocarcinoma of the cervix, do not respond in the same way."

* * * * *

G. Kolischer, M. D. (Chicago), Attending Surgeon to the Genito-urinary and Radiotherapeutic Departments, Michael Reese Hospital. Modern Cancer-therapy and its Results. Interstate Med. Journ. XXIV No. 7, pp. 637-40.

"Most recently published reports of cancer-therapy, exclusive of extirpation by the knife, are confined to the description of the mode of employment and the results of one single method. While such reports are essential for the evaluation of each procedure dealt with, the pursuance of such a monotyped restricted policy is not in harmony with the experience of some observers, especially interested in cancer work, that, at the present time, the best results may be obtained by a parallel employment of all the modern methods available. We know that in certain instances radioactive substances will produce effects that were denied to x-rays and vice-versa; we are also aware of the fact that, where technical restrictions are placed on the use of x-rays on account of the peculiarity of the case, radioactive substances may be employed to advantage."

"It is known that tumors having shown marked resistence to radiotherapy may become amenable to this method after they have been sensitized by autolysates and enzymes. We are in a position to make deep layers of tumors accessible to the influence of rays after their bulk has been removed by high frequency currents. It is a matter of experience that we may make progress with some method up to a certain point, and that then an absolute standstill will be observed, until a complementary method is called in, which then furnishes a complete result in some cases."

"It may therefore not be amiss to discuss the possibilities of all these methods at the instance of the individuality of certain cases."

"Experienced observers maintain that the application of rays to cancers of the tongue implies a risk out of proportion with the percentage of possible good results. The assertion is, that in the majority of cases the raying forms the stimulus for an excessive growth of the tumor. Whatever now the reasons for it are, or how plausible any theoretical explanation may be, the fact remains, that if diathermy is administered previous to raying, no such irritation will be observed, though a definite curative result may not be obtained."

"The coexistence of cervical glands in such cases will also be a factor in modeling the treatment. It is a common occurrence for the ray treatment of the original focus to lead to a fulminating growing of the glands—therefore it is advisable to deal with the glands first; that is to inject into them the enzymes and destroy them with the diatherm, after the reaction following the injection has subsided—then the treatment of the lingual tumor is started."

Palliative results will quite often be obtained to the great satisfaction of the patient and his attendants by the temporary repression of malignant tumors of the tonsils and fauces, both by diathermy and raying. Diathermy in the mouth, on account of its exquisite painfulness, has to be done under general anesthesia. The administration of ether by inhalation in such cases is not only inconvenient, but also involves the danger of igniting the ether vapors. All these drawbacks are avoided by obtaining general anethesia through the infusion of ether into the rectum."

If diathermy is decided upon, a previously performed tracheotomy is needed, to provide against suffocation by laryngeal edema, and an obturating canula will effectively deal with the danger of aspiration pneumonia. This prophylactic tracheotomy deserves some discussion. Every time that the larynx, or the trachea, or both are displaced even to a slight degree only, by tumefaction, there is a great danger present that the attempt at opening the windpipe may be followed by immediate death."

"The changing of the topography of the preliminary dissection, especially if a deep tracheotomy is aimed at, may lead to annihilation of the anyhow reduced breathing space and death by suffocation, before the trachea can be opened and the canula inserted. Therefore, in such cases, the patient ought to be placed in a sitting posture for the operation and previous to treacheotomy, intubation should be done. Such tracheotomies are performed very satisfactorily under local anesthesia. The oral and buccal mucosa is rather susceptible to the influence of radium and mesothorium and a successful employment of these sub-

stances may be frustated by the production of burns on not involved areas—this is apt to occur if proper protection is not provided for, because the character of the growths in these localities calls for the application of large quantities of radium or mesothorium during extended single seances. This consideration makes it imperative not only to use carriers that keep the radium capsule exactly and constantly in the desired place, but also to slip over the containing filter a leadcap fenestrated in such a way as to expose to the rays the tumor surface only, while the rest of the oral cavity is completely screened off."

"The same considerations hold good if a radioactive substance is introduced into the rectum in order to influence a prostatic tumor. Only the surface of the filter that is facing the prostate is left free, while the rest of its surface is screened off by a leadcap of sufficient thickness to shut off all rays from the rest of the rectal mucosa."

"In explanation of the injection of enzymes it may be mentioned that this procedure is believed to produce in the body defensive and protective ferments which instance in several cases seem to have exerted a decisive healing influence on malignant tumors, particularly so in cancers of the bladder, rectum and prostate."

"If an attempt is contemplated to administer enzyme- and radiotherapy to tumors of the vicera entirely enclosed in the abdomen, an approach to these tumors must be established. This is accomplished by opening the abdomen at a suitable place and by anchoring the tumor in this opening. This ought to be done in such a way that the function of the organ carrying the tumor is not interfered with or is substituted in an appropriate way (gastro-enterostomy, jejunostomy, colostomy), and that in case the treatment should be successful, normal conditions may be easily restored by a secondary operation."

"In the treatment of uterine cancers a distinction has to be made between cases that were not operated on at all and relapses after hysterectomy. In the former cases even if part of the portio vaginalis or the whole portio are destroyed and substituted by carcinoma there will be at least a crater left into which the radium or mesothorium container may be inserted, so as to utilize radiation in closest proximity to the cancerous growth. It also has to be kept in mind, that if a healing effect is obtained, cicatricial constriction will occur, thus preventing in time the insertion of the capsule high up inside of the uterus. This fact has to be kept track of, and dilation has to be restored to and repeated according to necessity every time it is found, that the upper pole of the container does not reach any more the top of the fundus uteri. In case the uterine cavity should be elongated two capsules have to be employed at each sitting, one for the corpus uteri, the other one for the cervix and portio vaginalis."

"If one has to deal with a relapse after hysterectomy for cancer as a rule the fornix vaginae is occupied by a more or less extensive tumor, and no cavity presents itself for the insertion of the capsule carrying the radioactive substance. The mere placing of the container into the vaginal stump would not answer the purpose because the larger part of the cancer would not be reached by the rays."

"In such cases it is of advantage to coagulate all the accessible parts of the tumor by diathermy, the sloughing will furnish then a cavity into

which the radium container may be placed, thus bringing parts of the tumor, otherwise not accessible within the reach of the radiation. In cancer of the prostate and cancers that occupy the base of the bladder the results will be far superior to the simple radiation, if the application of radium or mesothorium is at each time preceded by the injection of the enzyme into the tumor. This is easily accomplished by forcing a long needle through the perineum either into the prostate or into the base of the bladder, the course of the needle being controlled by an index finger inserted into the rectum. That the injection really has reached the spot is proven if, shortly after this application, general reaction sets in."

"In inoperable cancers of the mamma, primary or relapses, occasionally remarkable results may be obtained by the combination of diathermy and radiotherapy. In mammary cancer the enzyme therapy did not give any evidence of results."

"In summing up, there are on our records now as 'clinical cures' the following cases, the freedom of evidence of malignancy varying from three years to six months."

"Seven cases of cancer of the urinary bladder.

"Four cases of cancer of the tongue.

"Two cases of cancer of the rectum—one of them complicated with metastases in the inguinal glands.

"Three cases of cancer of the uterus.

"Two cases of cancer of the prostate.

"One case of cancer of the tonsil and anterior arch.

"One case of retroperitoneal sarcoma.

"Two of the cases reported carry a clinical diagnosis only.

"While these cases represent only about three per cent. of all the cases treated, it must be kept in mind, that every one of them was inoperable, and according to our previous standards absolutely hopeless. In this enumeration are not included the cases of flat epitheliomata of the face and epitheliomata of the lip, successfully treated in our department."

* * * * *

Th. Nogier. Rational Treatment of Malignant Tumors. Journ. de Radiologie et d'Electrologie, III, 515-19, No. 8, March-April, 1917. "Experience has shown that the remedy for cancer has not yet been found. Bold surgery made possible through asepsis has often been fruitless. Another proof is that a cure for cancer other than the knife is still being sought.

"If operation always cured cancer, or even cured it very often, it is certain that radium therapy and the many treatments with serum of collodial metals would not have been applied, or even developed, for the sufferer fears an operation less than a recurrence of the cancer with its inexorable consequences. One who has followed the stages of the fight waged everywhere against cancer, and the reports of thousands of results may doubt whether surgery is the *only* really good remedy for cancer. It is not my purpose to attack surgery—for it is only by the kindness of the surgeons of Lyons that I can here give my modest personal opinion, based on many years study in the hospital and more than

ten years study of private cases. What I wish is to give a logical idea, *plete* ablation of a neoplasm is the best available means to prolong the life in the treatment of malignant growths, and see what results they give:"

1. SURGERY. In human as well as experimental pathology, *complete* ablation of a neplasm is the best available means to prolong the life of a cancer patient. 'But to be effective it must be early' (Contamin-Experimental Cancer, p 206 et seq.).' When the removal is early and complete, it prolongs the life of the man or animal, when late, or incomplete, it activates the proliferation and whips up the malignity. What surgeon can say truly that the removal of a neoplasm has been complete? It is complete as judged by gross observations made with the eye or finger, but pathological histology and the marvelous sections which I have studied in the histological laboratory of my friend Prof. Regaud of the faculty of medicine at Lyons, have filled me with astonishment and fear. The microscope shows that in the skin, particularly in breast cancers, there exist far from the primary growth many groups of neoplastic cells. These are not seen or felt and remain dormant until after operation. Then they proliferate, each forming a complete little neoplasm. The recurrence has taken place. The operation because it was incomplete has only delayed the final outcome.

"The experimental researches of Haaland and Ehrlich have shown that often a cancerous tumor prevents the development or at least the rapid development of these buds of neoplastic cells which have formed about the primary growth. If this tumor is removed, the buds begin to grow. Ehrlich has proven the same fact for tumors inoculated in animals: the inoculations did not take if there is already a primary tumor. This phenomenon may be explained as follows (Ehrlich, Experimental Studies of Carcinoma in Mice): 'The first cancer being well vascularized has in its excessive growth completely removed from the blood the nutritive substances necessary for its development, so that there remains not enough for the later development of the secondarily inoculated cells; these find the much less favorable nutritive conditions, the same as cells carried away by embolism. An operation made in a region of neoplastic tissue, by breaking off virulent cells in the region of vessels, largely open, favors the forming of distant embolisms. Have we not recently removed from a patient operated on for a neoplasm of the left breast, a cutaneous nodule of recurrence in the skin of the right biceps? What of the embolisms of the deeper organs which are not visible and of which we know the consequences? Hence the ablation of a tumor, excellent when complete, is in most cases defective: 1. because the whole growth is not removed, and the seeds remain."

"2. Because these seeds develop better when the primary tumor is removed."

"3. Because operation favors the formation of distant embolism, sources of incurable metastases."

"Surgical operation, excepting those cases of very circumscribed tumors (closed so to speak since they have not yet produced any sprouts), and especially the tumors taken very early, only change the time of the fatal outcome."

RADIOTHERAPY OR RADIUMTHERAPY ALONE.

"We have seen what surgery alone can do. It is without action on the cancer cell, it removes but cannot modify it. Can radio- or radium-therapy do more? Yes. Every impartial mind must admit that the X-rays and radium rays can annihilate that power of boundless cellular development which constitutes the secret of cancer (Contamin). Hence the physical therapeutic methods can do more than surgery since they can kill the neoplastic cells, embedded in the living tissues. There are numerous cases of skin cancer cured without surgical intervention, and healed for years, without recurrence."

"However, in cancers of a certain size and in those deep lying, radio- and radium-therapy has only given exceptional cures."

"The reason for this anomaly is that until the last few years, it was not known how to make a sufficient concentration of the rays penetrate into the depths to kill the cancer cells, without seriously impairing the skin. A new era began with the deep radio-therapy and the use of rays of higher penetration. Professor Regaud and myself feel that we have helped make progress in this work. (Cf. Regaud and Th. Nogier. The effects produced in the skin by massive doses of X-rays filtered by passage through 3 and 4 mm. of aluminum. Application to Roentgen therapy. Work crowned by the Academy of Sciences, 1913)."

"Until we know more and until more work has been done, we cannot count on radio- or radium-therapy alone to cure cancer."

OPERATION FOLLOWED BY RADIO- OR RADIUM-THERAPY

"It has been said that it should be advantageous to remove the tumor first and then ray the field of operation as soon as the cicatrization has taken place."

"One might say that this was the method now in use and one that seems to be the method of the future. In his report on 'Deep Therapy' has not Dr. Bertolotti said 'The majority of surgeons have just proclaimed the necessity of post-operative prophylactic irradiation'?

"My experienc leads me to say: No, that is not where the truth lies."

"I have attended many patients after operation, most of them considerably later, with incipient recurrences and I can say that I have never had a definite cure. With the greatest patience, for years often, I have followed the metastases, but like Penelope I wove a cloth always to be rewoven. Certainly I have been able to maintain the patients in health for two, three, four or even more years, where without treatment they would have failed rapidly. But these results are obtained only at the price of great fatigue for the doctor and great patience on the part of the sufferer!"

"When after surgical operation, the neoplastic cells, germs of death, have been sowed in distant organs, it is too late to pursue them. Post-operative radiotherapy may lead to survival after an extensive and hastily performed operation, it will increase the chances of cure for the patient. In reality and in most cases it only prolongs existence.

EXTENSIVE RADIO- OR RADIUMTHERAPY FOLLOWED BY OPERATION.

"I do not hesitate to affirm that the future will be different in the systematic application of the following principle: radio- or radium-

therapy followed by excision. This should give results incomparably better than those obtained heretofore."

"This method can only be considered today because of the development of deep therapy, since previously the damage to the skin was an insurmountable obstacle."

"So all that was done before the era of intensive radiotherapy with heavy filters need not be taken into consideration."

"Professor Regaud and I have shown as a result of many animal experiments that enormous doses of filtered X-rays can be administered through the skin to sterilize thick neoplastic growths *leaving the skin intact.* We have shown that by suitably choosing the filters and the doses one could avoid having any special sensibility in this skin through a later traumatism (the operative trauma). We have shown and the facts which I have brought out at the Congress of Lyons are an elegant proof of this that sufficient doses of rays could produce rapid and almost miraculous changes in enormous tumors. It is therefore logical to utilize these experimental facts in the attempt to discover a rational treatment for cancer. In its larger outlines I have conceived it as follows:

"1. Before any intervention on a neoplasm no matter how limited it may appear I. Irradiate intensively with filtered rays; II. Irradiate the tumor at first and then the neighboring regions especially the lymphatics which are generally invaded; III. Then operate early, removing all that is microscopically visible."

"Let us see the advantage of this new method."

"The extensive irradiation of the tumor sterilizes the neoplastic cells which it contains. Even suppose that these cells have not lost all vitality they are incapable of giving rise to a flourishing metastasis. Bumm has furnished a very instructive case of an inoperable tumor of the uterus where surgical intervention only became possible after an intense radiotherapeutic treatment. During the operation the surgeon observed nodules of epithelial cells left unharmed through the field of operation; however, the patient was in a perfect state of health without any visible evidence of recurrence 15 months after the operation. This exceptional observation is so in opposition to a case incompletely operated on and not irradiated that we thought to take into serious consideration the explanation given by Bumm that it is possible the cancerous cells may be severely damaged while a histological examination would not make this damage visible. (Bertolotti. La therapie profonde, p. 25)."

"This is in accordance with the curious results of Wassermann and Ehrlich who showed that the X-rays as well as the gamma rays of radium seem to act directly on the cancer cell without killing it, by acting on the cellular function which governs the multiplication of the elements themselves (genocepter), whereas the other element of the living cell which governs the vital function of nutrition (nutricepter) does not seem to be effected by the radiations."

"These observations are somewhat analogus to our own experiments with ultra-violet rays wherein we found that bacteria having received a certain quantity of ultra-violet light will move for some time hence and remain alive, if movement is an external manifestation

of life, without being able to reproduce. (Th. Nogier. Arch. d'electricite medicale, Jan. 10, 1910, p. 12)."

"But the radiation of the tumor does not suffice; it is necessary to irradiate the neighboring tissues where the neoplastic cells are waiting to proliferate."

"This irradiation must be carried to the lymphatic ganglia of the region, since here we have a barrier to the neoplasm and this barrier would not be long in being passed with the production of a dissemination that would be irremediable."

"Finally we must operate to remove all that is visible of the neoplasm. The opening of vessels has not the same importance as in operating without a preliminary irradiation because if there is an embolism there are all chances that it will be sterile and not give rise to metastasis."

"But what will become of the more distant nodules which were not removed surgically? We must remember that they have been rayed and that their cells are damaged in their karyokinesis, they will therefore degenerate in place and be absorbed."

"But experiments made on animals prove that an animal having absorbed spontaneously or as a result of experimental intervention any part of a tumor which had begun to proliferate is immunized against reinocculation by this same tumor. (Contamin. Le cancer experimental, p. 287, 319, etc.)"

"So that these cells which escaped operation and became sources of recurrences after irradiation become a means of protection to the organism against reinfection by the same tumor."

"Let us reflect a while on the arguments which have been presented and I think we will be convinced that the new method of treatment which we have just outlined is the only rational method at least in the present state of our knowledge. Certainly this will not cure all cases for there can always exist neoplastic cells at depths sufficient to prevent their being influenced by the rays, but it will cure more cases and in a striking manner. When we have only methods of treatment which are partially effective we can, by combining them, arrive at a complete success which would not be obtained by the use of any method separately. To prepare the field for the scalpel and not to try to replace it should be the role accorded to the new radiations."

* * * * *

The 32nd Annual Report of the Memorial Hospital of New York City, covering the work of the year 1916, contains some interesting statements with regard to the radium department of the hospital. This department, as is well known, has received through the generosity of Dr. James Douglas a large endowment of radium amounting to nearly four grams of radium element. Most of this is now available and, to quote the report, "the past year has been a year of definite improvement in both the physical facilities and chemical achievements of the Radium Department." In this department Professor John S. Shearer, Ph.D., is the consulting physicist, Henry H. Janeway, M. D., physician-in-chief, Samuel Brown, M. D., assistant, Harold C. Bailey, M. D.,

gynecological service, Benjamin S. Barringer, M. D., genito-urinary service, and Gioacchino Failla, A. M., physicist. "The efficiency of the department has been increased by the addition of two assistants with whose aid the routine work of collecting the emanation and preparing the applicators can proceed without interfering with research for improved methods of application."

"All these features of the work will be greatly increased in efficiency when the new laboratory building now nearing completion is opened. One floor of this building will be given over to chemical work and another floor to physical work. The building will contain a work shop and a pathological laboratory, as well as a vault for storing the radium. The advantages of combining under one roof these related branches cannot fail in another year to increase the efficiency of the work."

"The results of radium treatment have in numerous instances more than met our expectations. It has been only during the past year that the hospital has had in its possession any very considerable quantity of radium. In consequence, it is really during this period that the most important part of its experience has been built up. Nevertheless we have records of many cases, exclusive of cancer of the skin, who have been so much improved that all objective signs of the disease have disappeared, and the patients seem at the present time well. Of these a considerable number belong to the more malignant forms of internal cancer."

"Along with these favorable results there have been others less favorable which have emphasized some of the limitations of radium and some of the dangers of pushing its application too far in advanced cases of cancer. Some of the palliative results are of much value, but considered with other cases of advanced cancer treated with radium they emphasize the importance of a very careful selection of the cases treated with a palliative end in view and an equal amount of care in planning of radium applications."

"The experience of the past year has enabled us to draw some definite conclusions regarding the use of radium in cancer. It has demonstrated that radium is not only an important palliative agent in advanced cancer but that it gives promise of becoming an effective agent in the treatment of the early stages of some of the more malignant varieties of cancer. We are looking forward with interest to the possibility of further confirming these conclusions."

"Cases admitted to the Radium Department during 1916: Brain 1, forehead 5, ear 1, eyelid and orbit 10, nose 13, face 16, lip 12, tongue 35, cheek 9, parotid 4, mandible 11, thyroid 1, neck 17, larynx 13, tonsil 12, antrum 15, palate 3, floor of mouth 9, temple 4, esophagus 12, pharynx 10, stomach 4, colon 1, bladder 16, prostate 21, uterus 93, vagina 1, rectum 26, penis 4, testis 2, breast 21, lymphosarcoma 8, keloid 1, extremities 13, vascular nevus 1, rhinoscleroma 1, lupus 2, hypernephroma 3, vulva 2, melanoma 4, ovary 1, chondroma 1. Total, 439."

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Hans Treber (Munich). Changes in Blood, Produced by Actinotherapy. Strahlentherapie, Vol. VI., pp. 308-404, Aug. 16, 1915. From the Gynecological Polyclinic, Munich. (Professor Dr. G. Klein, Director). The author has examined the blood of thirty-three carcinoma-

tous patients who underwent treatment with mesothorium in Klein's clinic, observations being made before and after the course of the mesothorium irradiation. The patients were all treated with 50 mgm. of mesothorium (equivalent of 27.6 mgm. of radium element) applied for varying intervals of 19 hours to 380 hours, the average being 72 hours. Treber found in 24 cases (73 %) there was an increase in the haemoglobin while it remained unchanged in 6 cases (8%), and in three cases (9%), all desperate cases, the haemoglobin content diminished. In most of the cases in a short time after the application of even small doses of mesothorium, a haemogobin increase of 10 to 15 or more per cent. was observed.

With the increase in haemoglobin there was almost always an increase in the red blood cells.

As regards the behavior of the leucocytes, Treber found in 22 patients (67 %) a diminution. A rapid fall of the leucocytes, such as Christof Mueller describes, after Roentgen treatment was observed in 6 cases (18 %). In these cases the leucocyte count fell from normal to less than 4800. The mesothorium dose appears to play no essential part since in the one case mentioned above the leucocyte count fell from normal to 3000.

Treber's observations on 10 cases treated by Roentgen therapy indicate that the higher the dosage the greater the fall in the leucocyte count. However, in the short time elapsing after the treatment (from less than a day to several days), the haemoglobin content was found to be little changed although there seemed to be a favorable influence due to the irradiation. Likewise, the red blood count increased somewhat as a result of the irradiation.

Treber summarizes the results already given in the literature as follows:

Wetterer. Handbuch der Roentgentherapie, Vol. II., p. 571. Diseases of the Blood and Haemopeotic Organs. It was here recorded that Grawitz observed a case of leukaemia in which in the course of Roentgen treatments every six weeks the number of white cells fell from 1,250,000 to 8,000. Similar results were observed by Krause, Holzknecht, Brown, Beclere and other authors.

Nicolas von Jagee, Gottwald Schwarz and Leo von Slebenrock. Observations on the Blood of Radiologists. Berl. klin. Wochenschr., No. 27, 1911. The authors examined 10 persons who had been working in Roentgen laboratories for a long time (up to 16 years). They found in practically all of the cases a slight diminution in the leucocyte count. The diminution invariably concerned the neutrophile polymorpholeucocytes, the lymphocytes being invariably increased in absolute amount.

Aubertin. The Blood of Radiologists. Arch. d'Electr. med. No. 328. Aubertin examined 16 persons who had been exposed for a long time to X-rays. In 6 cases there was a diminution of leucocytes, the polynuclear neutrophiles being decreased. In the remaining 10 there were only slight changes in the leucocytes.

Falta, Chemical and Biological Action of Radioactive Materials. Strahlentherapie, Vol. II., 1913. This author found a leukopenia after the injection of strong doses of radium emanation. Furthermore, in the case of persons employed in the manufacture of radium preparations there was an increase in the red blood cells.

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